2.10 200-BP-5 Operable Unit

J. L. Smoot

This section describes the groundwater flow and contaminant distributions in the 200-BP-5 Operable Unit, which includes portions of the 200 East and 600 Areas (Figure 1.0-1). Figures 2.10-1 and 2.10-2 show facilities, wells, and shoreline monitoring sites in the 200 East Area and 600 Area, respectively.

Groundwater is monitored in the 200-BP-5 Operable Unit to track the evolution of several zones of contamination.

A groundwater flow divide likely occurs in the 200 East Area with southeast flow in the southern part of this area (Figure 2.10-3). Small differences in water elevations make it difficult to define the exact location of this groundwater divide. Near the Waste Management Area (WMA) B-BX-BY and Low-Level WMA 1, the average flow direction is to the north-northwest through Gable Gap. The flow direction along the southern boundary of the 200-BP-5 Operable Unit is uncertain. The range in water-table elevations is only a few centimeters across the 200 East Area, but the water level measurements in wells exhibit greater variability. Methods being used to reduce uncertainty in these measurements include higher resolution well elevation surveys and gyroscopic surveys to determine borehole deviation from vertical.

The 200-BP-5 Operable Unit does not contain any active groundwater remediation. The groundwater contamination in this operable unit generally has remained steady, with some natural attenuation of contaminant concentrations observed along with incremental degradation of water quality near selected sites. Contaminants of concern in this operable unit include technetium-99 and uranium, and to a lesser extent, cyanide and nitrate; little change in the distribution of these contaminants was observed in fiscal year (FY) 2008. Though more limited in terms of areal distribution, uranium also has recently been recognized as an important contaminant of concern. Groundwater is monitored in this operable unit to define the regional extent of technetium-99, uranium, tritium, iodine-129, and nitrate. Via indicator parameters, the groundwater monitoring also helps observe the local extent of contamination associated with specific *Resource Conservation and Recovery Act of 1976* (RCRA) treatment, storage, and disposal units in the area. For example, several tank farms exhibit elevated specific conductance in groundwater.

Small differences in water elevations require precise measurements to define the water-table surface in portions of the 200-BP-5 Operable Unit.

The upper-basalt confined aquifer also is monitored in the 200-BP-5 Operable Unit because of the potential for migration of contaminants from the overlying unconfined aquifer. Because of the fractured nature of basalt, vertical hydraulic conductivities are relatively high in general and vertical leaks between basalt aquifers is approximately several centimeters per year. Drilling data from well 699-53-55A suggests that the Hanford formation unconformably overlies the Rattlesnake Ridge interbed in this location (DOE/RL-2005-76, *Sampling and Analysis Plan for Calendar Year 2005 Well Drilling at the 200-BP-5 Operable Unit*). Drilling data from well 699-55-60A are less clear, indicating that this well may have reached only the base of the Hanford formation. Consequently, there may be vertical pathways through the basalt as well as through zones where the upper basalt is thin or absent. Several wells were drilled into the confined aquifer as part of FY 2008 work in the operable unit; major findings included technetium-99 concentrations on the order of 20,000 pCi/L (Section 2.14).

Some of the main concepts associated with the 200-BP-5 Operable Unit include the following.

- Sources of groundwater contamination included trenches, cribs, ponds, a reverse well, and single-shell tank farms that formerly leaked. These facilities are currently inactive, and pumpable liquids have been removed from the tanks. However, the waste sites have not yet been remediated and contamination remains in the vadose zone.
- The amount and extent of vadose zone contamination within the operable unit continues to be poorly understood. However, the rise in concentration of selected contaminants in groundwater suggests that the vadose zone continues to behave as a conduit for facility-derived contaminants.
- Active facilities include Low-Level Burial Grounds and the Liquid Effluent Retention Facility.
- Groundwater contaminants include tritium, technetium-99, uranium, nitrate, iodine-129, cobalt-60, cyanide, strontium-90, cesium-137, and plutonium-239/240.
- Only incremental changes were observed in groundwater quality during FY 2008.
- The operable unit does not contain any active groundwater remediation. Remedial investigations are underway in support of final cleanup decisions.
- Six RCRA sites are located in the operable unit. WMA B-BX-BY continued under an assessment monitoring program. At Waste Management Area C, the indicator parameter specific conductance is increasing in a downgradient well. If the trend continues, the site may require assessment monitoring. The other RCRA sites continued previously-established monitoring programs. Two new wells were installed to monitor the fractured basalt flow-top at the Liquid Effluent Retention Facility.
- The unconfined aquifer is 0 to over 40 m thick and includes parts of the Ringold and Hanford formations and the fractured flow top of the underlying basalt. Additional work is needed to understand the impact of the fractured basalt on the unconfined aquifer.

The groundwater in the 200-BP-5 Operable Unit is monitored for the objectives of the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), the *Atomic Energy Act of 1954* (AEA), and several RCRA units. The RCRA sites in the 200-BP-5 Operable Unit are the single-shell tank farms at WMA B-BX-BY and WMA C, plus Low-Level WMAs 1 and 2, the Liquid Effluent Retention Facility, and the 216-B-63 Trench. Section 2.10.1 provides contaminant plumes and concentration trends for contaminants of concern. Section 2.10.2 discusses aspects of groundwater monitoring specific to the 200-BP-5 Operable Unit. Section BY2.10.3 presents specific information regarding contaminant distribution for RCRA units within the operable unit.

2.10.1 Groundwater Contaminants

J. L. Smoot and G. S. Thomas

Several areas of groundwater contamination are monitored in the 200-BP-5 Operable Unit. Specific information is provided for plumes associated with several CERCLA units (i.e., 216-B-5 Reverse Well, BY Cribs, and Gable Mountain Pond) and general information is provided regarding regional contaminant distribution, particularly in Gable Gap.

Wells in the 200-BP-5 Operable Unit are sampled for constituents based on the data quality objectives process (PNNL-14049; WMP-28945): tritium, nitrate, iodine-129, technetium-99, cobalt-60, cyanide, uranium, strontium-90, cesium-137, plutonium-239/240, sulfate, and mercury.

Plume areas (square kilometers) above the drinking water standard in the 200-BP-5 Operable Unit:

Cyanide — 0.28
Iodine-129 — 6.46
Nitrate — 4.32
Strontium-90 — 0.65
Technetium-99 — 2.05
Tritium — 0.05
Uranium — 0.40

2.10.1.1 Tritium

Tritium contamination is widespread at relatively low levels throughout the northwestern part of the 200 East Area and more broadly throughout the operable unit (Figure 1.0-2). The contamination extends north through Gable Gap to the Columbia River and southeast into the 200-PO-1 Operable Unit.

Tritium concentrations at or just below the drinking water standard (20,000 pCi/L) are present between Gable Mountain and Gable Butte. Tritium concentrations from well 699-61-62 (17,000 pCi/L) in Gable Gap declined from FY 2007 (18,000 pCi/L). Tritium concentrations in well 699-60-60 (20,000 pCi/L) remained steady and in well 699-64-62 (14,000 pCi/L) were consistent with a downward trend over the past decade. Tritium concentrations are continuing to decline at the south end of WMA B-BX-BY, with a relatively smaller zone defined by the 10,000 pCi/L contour reported in FY 2008.

The only other area where tritium concentrations were above the drinking water standard in the operable unit was in the northern portion of the 200 East Area beneath and adjacent to the BY Cribs. Peak concentrations were reported in wells 299-E33-4 (170,000 pCi/L) and 299-E33-7 (78,000 pCi/L) beneath the northern portion of the BY Cribs. These peak concentrations were similar to FY 2007. There was no significant change in plume extent from last year.

2.10.1.2 Nitrate

A nitrate plume originating in the 200 East Area extends northwest through Gable Gap toward the Columbia River. Nitrate is a contributor to specific conductance, an indicator parameter that is tracked at regular intervals for RCRA monitoring in the operable unit (Appendix B). The nitrate contamination within the northwest part of the 200 East Area consists of two plumes. One of the plumes is beneath the western portion of Low-Level WMA 1. The second plume extends from the northern portion of the BY Cribs (Figure 2.10-4) to the 216-B-8 Crib. The northwestern portion of the nitrate plume extends through Gable Gap towards the Columbia River at levels less than the drinking water standard (45 mg/L).

Elevated nitrate concentrations are evident in the vicinity of the BY and 216-B-8 Cribs, and at one well in WMA C.

The nitrate plume extending through the western portion of Low-Level WMA 1 appears to be part of a larger plume originating from the Plutonium-Uranium Extraction (PUREX) Plant and associated cribs (PNL-6463, *The Predicted Impacts to the Groundwater and Columbia River from Ammoniated Water Discharges to the 216-A-36B Crib*). Other potential historical sources for this plume are facilities in the northern part of the 200 East Area (e.g., BY Cribs). This plume apparently moved to the northwest under past flow conditions during the period of high discharge to 200 East Area facilities and the B Pond.

Nitrate also is found in localized plumes east of Low-Level WMA 2 and beneath WMA C and WMA B-BX-BY. Nitrate was used in the chemical processing of spent fuel rods. As such, it was discharged to tanks as well as cribs. The highest nitrate concentrations in the 200 East Area are in the vicinity of the BY and 216-B-8 Cribs. High concentrations of nitrate are coincident with cobalt-60, cyanide, and technetium-99 contamination originating from the BY Cribs (PNNL-13080). The highest nitrate concentration measured in FY 2008 was in well 299-E33-4 (17,000 mg/L) near the BY Cribs, although this sample came from a nearly dry well that was collected via bailing rather than pumping. During FY 2008, the highest concentration of nitrate for the 216-B-8 Crib was in well 299-E33-16 (854 mg/L). Uranium from WMA B-BX-BY is known to contaminate groundwater, so some nitrate from that unit likely is present.

Nitrate continues to be detected in wells monitoring Gable Mountain Pond at levels above the drinking water standard. In FY 2008, a nitrate concentrations of 93 mg/L and 170 mg/L were measured in wells 699-53-47A and 699-53-48A, respectively.

2.10.1.3 Iodine-129

Iodine-129 contamination is present throughout the operable unit at relatively low levels, extending to the northwest toward Gable Gap and southeast into the 200-PO-1 Operable Unit. Levels greater than the drinking water standard (1 pCi/L) have not passed beyond Gable Gap. A region of wells with historically elevated concentrations in WMA B-BX-BY reported generally less than 5 pCi/L during FY 2008 (Figure 2.10-5). However, there was measurable elongation of the plume to the northwest from WMA B-BX-BY and an increase in the small plume west of West Lake to over 2 pCi/L.

2.10.1.4 Technetium-99

A plume of technetium-99 extends from the area of the BY Cribs to the northwest. The plume has moved through Gable Gap at levels below the drinking water standards.

A plume of technetium-99 extends from the area of the BY Cribs and WMA B-BX-BY to the northwest (Figure 2.10-6). The source is attributed to past discharges of ferrocyanide-containing waste to the BY Cribs (PNNL-13080; PNNL-14049). The areal extent of the plume did not appear to change significantly in FY 2008. A significant portion of the plume is north of the 200 East Area boundary and may represent releases of technetium-99 from the BY Cribs (PNNL-13080), but near-field technetium-99 concentration levels are the result of more recent contributions from tanks and local cribs. During FY 2008, a maximum concentration of 100,000 pCi/L was observed in well 299-E33-4, while concentrations of technetium-99 in wells 699-49-57A and 699-50-59 exhibited a slightly increasing trend downgradient (4,900 pCi/L and 1,400 pCi/L, respectively). In general, this plume exhibited slightly increasing concentrations that appear to originate in the vicinity of WMA B-BX-BY. Detections west of Gable Mountain Pond are consistent with the movement of other analytes. The areal extent of this plume did not change significantly, but moderate concentration increases were observed at some well locations within the plume.

2.10.1.5 Cobalt-60 and Cyanide

Cobalt-60 and cyanide continue to be detected in a number of wells in the operable unit. Cobalt-60 concentrations generally are at levels less than the drinking water standard (100 pCi/L) and cyanide is found at levels above the drinking water standard (200 µg/L) only near the BY Cribs. These constituents are useful for distinguishing contaminant groups and contaminant sources and were generally associated with ferrocyanide waste streams generated by uranium scavenging operations conducted during the mid-1950s; consequently, cyanide and cobalt-60 are generally found together in this area. Cobalt-60 is present in the soil column, as evident by detection in dry wells.

The highest cobalt-60 values were detected in wells monitoring the BY Cribs, which are the probable sources of the contamination. The highest cobalt-60 concentration in FY 2008 was in well 299-E33-4 (1,040 pCi/L).

Cyanide contamination continues to extend from the BY Cribs vicinity several kilometers to the northwest (Figure 2.10-7). Well 299-E33-4 had the maximum cyanide concentration (7,180 µg/L) for the 200-BP-5 Operable Unit. Well 299-E33-38 had a maximum cyanide value of 936 µg/L in FY 2008. Cyanide contamination trends in wells located at the BY Cribs are similar to those of technetium-99, cobalt-60, and nitrate and may be related to past discharges of ferrocyanide waste to the BY Cribs (PNNL-13080; PNNL-14049) and possibly BY Tank Farm.

2.10.1.6 Uranium

Uranium contamination in the 200-BP-5 Operable Unit is limited to three areas.

Uranium contamination in the 200-BP-5 Operable Unit is limited to three isolated areas:

- Wells monitoring WMA B-BX-BY and BY Cribs
- Wells near the 216-B-5 Injection Well
- Wells at the 216-B-62 Crib.

Wells in two of these areas exceeded the drinking water standard for uranium (30 µg/L) during FY 2008. Figure 2.10-8 shows the average uranium concentrations in northwestern 200 East Area.

Multiple sources contribute to the uranium groundwater contamination in WMA B-BX-BY. Currently, the primary source is the tank 241-BX-102 unplanned release (PNNL-14187; Christensen et al., 2004; Sobczyk, 2004). The contamination is present in a narrow northwest-southeastern band. The BY Cribs concentrations have a significant uranium inventory, ~775 kg (RPP-26744, *Hanford Soil Inventory Model, Rev. 1*), and are a potential contributor. The FY 2008 uranium concentration in well 699-49-57A (21 µg/L) is part of an increasing trend and suggests that uranium continues to migrate slowly to the northwest toward Gable Gap with other constituents. In FY 2008, the highest uranium concentrations were detected in wells 299-E33-343 (4,260 µg/L), 299-E33-9 (1,300 µg/L), 299-E33-18 (831 µg/L), and 299-E33-38 (388 µg/L). Section 2.10.3.1 provides a detailed discussion of uranium at WMA B-BX-BY.

Uranium contamination occurs with cesium-137, plutonium, and strontium-90 contamination found at the former 216-B-5 Injection Well. The highest uranium concentration detected in FY 2008 in this area was 29 µg/L in well 299-E28-23, close to the injection well (Figures 2.10-1 and 2.10-8). Uranium values were significantly lower farther from the injection well.

Uranium was detected consistently at levels slightly above the drinking water standard in wells monitoring the 216-B-62 Crib, located south of Low-Level WMA 1 (Figure 2.10-8). The maximum FY 2008 uranium concentration at the 216-B-62 Crib was 33.4 µg/L for well 299-E28-18. Uranium concentration levels between 15 and 18 µg/L also were detected along the west side of Low-Level WMA 1, but no wells in this area exceeded the drinking water standard in FY 2008. The uranium detected on the west side of Low-Level WMA 1 may have originated at the 216-B-62 Crib or its predecessor, the 216-B-12 Crib.

2.10.1.7 Cesium-137 and Strontium-90

The zone of strontium-90 contamination remained stable in the vicinity of Gable Mountain Pond.

Cesium-137 has relatively low mobility and is generally found near the source. Well 299-E28-23 near the 216-B-5 Injection Well consistently has concentrations of cesium-137 greater than the drinking water standard (200 pCi/L), but less that the U.S. Department of Energy (DOE) derived concentration guide (3,000 pCi/L). In FY 2008, values of 1,620 and 1,650 pCi/L were reported for this well; concentrations have risen steadily in this well since 2005, but these concentrations are much lower than historic levels This cesium-137 was injected at or near the water table through the 216-B-5 Injection Well; this practice has long since been discontinued. All other wells sampled at this site had cesium-137 concentrations below the drinking water standard in FY 2008.

Several of these wells continued to have strontium-90 concentrations greater than the DOE derived concentration guide (1,000 pCi/L) in FY 2008. Well 299-E28-23 had the highest strontium-90 concentration, with a value of 3,740 pCi/L in FY 2008. Concentrations generally have been declining in this well since 2000. Strontium-90 also exceeded the DOE derived concentration guide in well 299-E28-25 (1,500 pCi/L), although this value is approximately 100 pCi/L less than FY 2007.

Strontium-90 concentrations have declined since 2000 in several wells near Gable Mountain Pond, but remain above the drinking water standard. The zone of contamination did not change significantly during FY 2008. Well 699-53-48A had a value of 200 pCi/L, down from 329 pCi/L in FY 2007. Strontium-90 concentrations in both wells have decreased from the late 1990s.

2.10.1.8 Plutonium

Plutonium-239 and plutonium-240 (reported as plutonium-239/240) were detected in past years in samples taken from several wells near the 216-B-5 Injection Well. Because it is relatively immobile, plutonium contamination is found only near the injection well. The maximum reported plutonium-239/240 concentration in FY 2008 was 27 pCi/L for well 299-E28-23, below the DOE derived concentration guide for plutonium (30 pCi/L). Other wells sampled near the 216-B-5 Injection Well also have had plutonium levels below the DOE derived concentration guide in recent years.

2.10.1.9 Sulfate

Sulfate concentrations have increased over the operable unit since the mid to late 1990s and continue to locally exceed the secondary drinking water standard. This constituent also contributes to levels of the indicator parameter specific conductance that is elevated in some areas, particularly in WMA C, BY Cribs, and the 216-B-8 Crib. The secondary drinking water standard of sulfate (250 mg/L) recently has been exceeded in wells 299-E33-4 and 299-E33-16, among others. Figure 2.10-9 shows sulfate distribution.

2.10.1.10 Mercury

Mercury, which has a drinking water standard of 2 µg/L, has been detected sporadically at low levels in the northwest portion of the 200 East Area in some wells monitoring the BY Cribs and low-level burial grounds. In most wells in this area, samples have been analyzed routinely for mercury since the late 1980s. The majority of results during this period have been below detection limits (ranging from 0.05 to 0.2 µg/L). Recently, however, mercury results in a few wells have been above detection limits. Well 299-E33-7 has shown high levels in the past but was not sampled in FY 2008. Well 299-E33-34 (located near the northeast corner of Low-Level WMA 1) also has shown consistent detections of mercury (0.18 µg/L in FY 2008). Section 2.10.3.3 provides additional discussion of mercury in this area.

2.10.2 Operable Unit Activities

G. S. Thomas

CERCLA monitoring requirements in the operable unit have been defined in the sampling and analysis plan (DOE/RL-2001-49, *Groundwater Sampling and Analysis Plan for the 200-BP-5 Operable Unit*). The sampling and analysis plan was revised in late FY 2004 to integrate AEA monitoring and make minor modifications in the monitoring network. The revised monitoring plan was implemented in FY 2005. CERCLA monitoring includes sampling of the regional plumes, 216-B-5 Injection Well site, BY Cribs, and Gable Mountain Pond. Results of monitoring are discussed in Section 2.10.1. An interim or final record of decision is yet to be established for the operable unit. This report is the only formal report presently being prepared on a regular basis for the unit.

CERCLA monitoring in the 200-BP-5 Operable Unit includes sampling of the regional plumes, 216-B-5 Injection Well site, BY Cribs, and Gable Mountain Pond.

2.10.2.1 Remedial Investigation/Feasibility Study

Within the 200-BP-5 Operable Unit, remedial investigation actions have been implemented for determining the appropriate remedial actions and extent of contamination for several potential contaminants of concern. Through FY 2008, four of the seven investigation areas targeted in the DOE/RL-2007-18, *Remedial Investigation/Feasibility Study Work Plan for the 200-BP-5 Groundwater Operable Unit*, were completed. Enhanced monitoring activities (including expansion of constituent analyses and frequency at key existing wells, addition of new wells, and the extensive work associated with deriving the groundwater gradient at the Low-Level WMA 1) provided the necessary information for determining contaminant sources, the extent of contamination, the groundwater flow direction, and the approximate gradient in the northern portion of the 200 East where previously much uncertainty existed.

Within the 200-BP-5 Operable Unit, remedial investigation actions were continued for the growing uranium and technetium-99 plumes beneath the WMA B-BX-BY and surrounding past practice liquid effluent waste sites. During FY 2008, installation of five wells was completed in this area. Four of the investigation wells (299-E33-341, 299-E33-342, 299-E33-343, and 299-E33-345; Figure 2.10-1) were completed in the unconfined aquifer. These wells provided the opportunity to collect both vadose zone and aquifer sediments. In addition, these wells provided better definition of the uranium and technetium-99 plumes. One well (299-E33-344) was installed in a perching horizon ~3.0 m above the unconfined aquifer. Wells 299-E33-343, 299-E33-344, and 299-E33-345 provided information on the lateral extent of vadose zone contaminant migration from the unplanned release at tank 241-BX-102.

A pumping test from new well 299-E33-345 also provided information regarding the variable aquifer transmissive properties in this area.

Three other areas within the 200-BP-5 Operable Unit were investigated during FY 2008. These investigations were targeted at determining the extent and flow pathway of technetium-99. The target areas included collection of depth discrete sediment samples and installation of wells at the following locations (Figure 2.10-1):

- Well 299-E27-155, located southwest of WMA C
- Well 299-E33-340, located in the basalt-confined aquifer north of the WMA B-BX-BY and surrounding past practice liquid effluent waste sites (although drilled and sampled in FY 2008, the well was not accepted until FY 2009)
- Well 699-52-55, located approximately 1,700 m north of 200 East Area along the northern portion of the anticline ridge and south of the basalt erosion window
- Well 699-52-55B, located next to well 699-52-55 drilled an additional 33.5 m deeper and screened from 69.5 to 75.5m.

These investigations provided valuable information towards the conceptual transport model and development of the baseline risk assessment. In addition, a slug test from new well 699-52-55 provided information regarding the low aquifer transmissive properties in this area. Results of activities described in this section will be published as part of the remedial investigation/feasibility study.

2.10.2.2 CERCLA Monitoring

Groundwater monitoring in FY 2008 included sampling at the existing monitoring wells in the 200-BP-5 Operable Unit per DOE/RL-2001-49 at least annually, although some wells are sampled up to three times a year. Triennial sampling is performed for wells that have shown stable trends for several years. These wells are generally supplemented by RCRA requirements, allowing surrogate trend analysis to be reviewed to ensure stable trends are maintained. Quarterly to semiannual sampling is completed in areas where contaminant concentrations are changing. As a result of increasing contamination and WMP-28945 new wells, increased sampling frequency, and additional chemical constituent analyses were identified at certain wells. The information derived from these activities has provided evidence for the source of the uranium plume and its flow direction (Section 2.10.1.6). In addition, it has provided clarity regarding the contaminant suite associated with the BY Cribs. Wells 299-E27-155 and 299-E33-340 have provided information on the size of the technetium-99 plume at WMA C and in the basalt confined aquifer, respectively.

Overall contaminant concentration increases were associated mainly with the WMA B-BX-BY and associated past practice liquid effluent waste sites. Although new peak concentrations were reported in this area, the extent of contaminant migration is minimal because of the low hydraulic gradient in this area.

All but three wells in FY 2008 were successfully sampled (well 299-53-47A did not sustain flow, well 299-49-55A inadvertently was not scheduled, and 299-52-55 was delayed until early FY 2009). Sampling at one well was unsuccessful and sampling at another was delayed until early FY 2009. In addition, a few analyses were not completed at thirteen wells. The analyses not complete were Pu-239/240, Sr-90, total organic carbon and total organic halogen. The analyses in FY 2007 for these wells were all reported as undetected. The 200-BP-5 Operable Unit monitoring network and analytes are listed in Appendix A.

2.10.3 Facility Monitoring

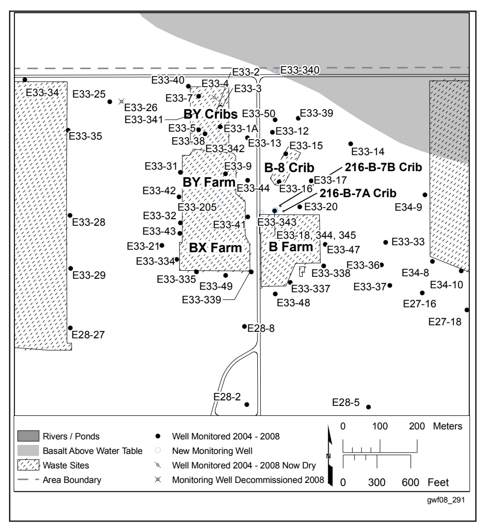
J. L. Smoot and C. J. Martin

This section describes results of monitoring at individual units (i.e., treatment, storage, and disposal units or tank farms). Some of these facilities are monitored under the requirements of RCRA for hazardous waste constituents and AEA for source, special nuclear, and by-product materials. Data from facility-specific monitoring also are integrated into the CERCLA groundwater investigations. Hazardous constituents and radionuclides are discussed jointly in this section to provide comprehensive interpretations of groundwater contamination for each facility. Pursuant to RCRA, the source, special nuclear, and by-product material components of radioactive mixed waste are not regulated under RCRA and are regulated by the DOE acting pursuant to its AEA authority. While this report may satisfy RCRA reporting requirements, the inclusion of information on radionuclides in such a context is for information only and may not be used to create conditions or other restrictions set forth in any RCRA permit.

The 200-BP-5 Operable Unit contains six RCRA sites with groundwater monitoring requirements: WMA B-BX-BY, 216-B-63 Trench, Low-Level WMAs 1 and 2, Liquid Effluent Retention Facility, and WMA C. The primary RCRA indicator parameters monitored are pH, specific conductance, total organic carbon, and total organic halides. This section summarizes results of statistical comparisons, assessment studies, and other developments for FY 2008. Groundwater data are available in the Hanford Environmental Information System database and on the data files accompanying this report. Additional information (including well and constituent lists, maps, flow rates, and statistical tables) are included in Appendix B.

2.10.3.1 Waste Management Area B-BX-BY

Located in the northwest part of the 200 East Area, this WMA consists of the B, BX, and BY Tank Farms, ancillary waste transfer lines, and diversion boxes. The three farms consist of 36 underground tanks ranging from 2- to 2.9-million-liter capacity and four 208,000-liter tanks constructed between 1945 and 1949. Seventeen of the larger tanks and three of the smaller tanks are known or suspected to have leaked in the past.



Monitored under the requirements of RCRA and AEA, WMA B-BX-BY is currently in a RCRA groundwater quality assessment program and is monitored quarterly, as detailed in the RCRA assessment plan (PNNL-13022, *Groundwater Quality Assessment Plan for Single-Shell Tank Waste Management Area B-BX-BY at the Hanford Site*). Sampling also helps monitor for new occurrences of groundwater contamination potentially related to current farm operations (e.g., tank closures). In addition to monitoring hazardous waste/hazardous waste constituents for RCRA assessment, the site is monitored for CERCLA and AEA purposes under the 200-BP-5 Groundwater Operable Unit program.

Groundwater in the vicinity of WMA B-BX-BY flows towards the northwest in the direction of Gable Gap. WMA B-BX-BY lies within the region of divergent flow to the northwest within the 200-BP-5 Operable Unit. Groundwater gradients are small (i.e., 1×10^{-05}), as seen by the small changes in plume shape from year to year.

WMA B-BX-BY appears to be a significant source of AEA-regulated contamination in the 200-BP-5 Operable Unit.

Wells specified in the assessment plan (PNNL-13022) near the facility and in nearby past-practice liquid disposal facilities are sampled quarterly to differentiate tank-related contamination from contamination associated with the surrounding waste facilities. Well 299-E33-9, located in the BY Tank Farm, is toward the northern end of uranium contamination (1,300 μg/L in FY 2008) in this area with slightly higher levels southeast near the 216-B-7A and 216-B-7B Cribs. Although scheduled for quarterly sampling, this well is inside the tank farm fence and access is limited, even for sampling teams, which prevented three of the scheduled samples. Third quarter sampling was unsuccessful in wells 299-E33-339 and 299-E33-17. Rescheduled samples were successfully collected in both wells during the fourth quarter of FY 2008. Fourth quarter sampling was unsuccessful in well 299-E33-47 and is rescheduled for early FY 2009. Some far-field wells are sampled semi-annually to provide information under surrounding past-practice liquid effluent disposal facilities such as the BY Cribs, the 216-B-8 Crib, and the 216-B-7A and 216-B-7B Cribs. The far-field wells are not included in the assessment plan, but data from these wells are critical to distinguishing nontank farm sources that may have impacted groundwater quality from tank-related sources. Radionuclides are tracked under AEA monitoring at the site. Appendix B includes a well location map, an estimate of local migration rates, and a list of wells and the constituents monitored for WMA B-BX-BY.

Assessment studies have identified several distinct suites of contaminants (PNNL-13116; PNNL-14187; PNNL-14548). A brief description of these contaminant suites is provided below. Previous reports provide more complete discussions about links between the contaminant suites and potential sources (PNNL-15070; PNNL-13116; PNNL-14187; PNNL-14548; PNNL-13788).

Several contaminant plumes coincide with WMA B-BX-BY, and the source is most likely from within the WMA. Nitrate, technetium-99, and uranium are observed together under and southeast of the BY Tank Farm. The proximity of these contaminants to the BY Tank Farm suggests a possible tank-related source. Technetium-99, nitrate, uranium, sulfate, tritium, cobalt-60, and cyanide occur together in the vicinity of the BY Cribs, and, with the exception of uranium, at high concentrations. Elevated iron and manganese also are in the groundwater above the drinking water standards (300 μg/L and 50 μg/L, respectively) under the BY Tank Farm. In the vicinity of the 216-B-8 Crib, nitrate, nitrite, technetium-99, and uranium contamination coincides. In general, many of these contaminants occur together in tank and crib waste and their coincidence in groundwater monitoring is expected.

Nitrate. Nitrate is prevalent in WMA B-BX-BY as part of process wastes discharged to both tanks and cribs. Generally, nitrate extends along a northwestern-southeastern trend, from the northeastern corner of Low-Level WMA 1 through the BY Cribs to the northern part of the 216-B-8 Crib and extending on to the north-northwest away from the WMA. DOE/RL-2008-01 provides an extensive history of the nitrate plume. No significant changes are observed in FY 2008. Nitrate concentrations continued to increase beneath both the BY Cribs and the 216-B-8 Crib. The maximum concentration for FY 2008 was beneath the BY Cribs at well 299-E33-7.

Technetium-99. Technetium-99 contamination is observed in the vicinity of the BY Cribs, at the 216-B-8 Crib, and near the 216-B-7A and 216-B-7B Cribs. Relatively stable to slightly increasing concentration trends continued in FY 2008. The maximum concentration was 100,000 pCi/L detected in well 299-E33-4 with the next highest value of 37,000 pCi/L detected in well 299-E33-7, which is at the northwest corner of the BY Cribs. Mapping of the extent of technetium-99 migration indicates some southward movement of this contaminant across the southern border of the BX and B Tank Farms. There is no other suspected source of technetium-99 to contribute to groundwater contamination in this area, although historical records suggest that some tank systems may have been discharged to this crib.

Cyanide. Cyanide concentrations from scavenged waste disposed to the BY Cribs continued to increase in groundwater under the BY Cribs, ranging from less than 4 µg/L to 7,180 µg/L in well 299-E33-4. The cyanide plume extends several kilometers to the northwest. Historically, low levels of cyanide were detected under the BY Tank Farm in well 299-E33-9, which also has the maximum uranium concentration. However, during FY 2008, low levels of cyanide were detected east of the BY Tank Farm in well 299-E33-44 (32.2 µg/L) and at the 216-B-8 Crib in well 299-E33-15 (169 µg/L). The 216-B-8 Crib did not receive scavenged waste.

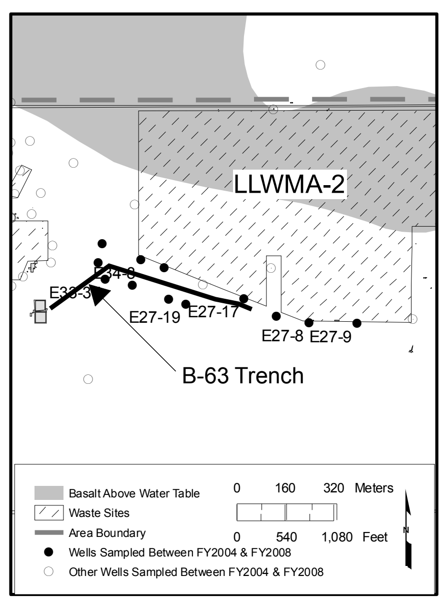
Uranium. The likely source of the observed contamination is within WMA B-BX-BY; the tank 241-BX-102 unplanned release is the likely source. The transport of uranium contamination suggests groundwater flow to the northwest (Figure 2.10-8). This interpretation is consistent with recent detailed water-level interpretation in the vicinity of Low-Level WMA 1. Uranium levels in the south part of the WMA are much lower. The historic center of uranium contamination is under the BY Tank Farm adjacent to and south of well 299-E33-9. In FY 2008, the concentration in well 299-E33-18 was 1,330 µg/L. The maximum uranium concentration in FY 2008 (4,260 µg/L) was detected in newly installed well 299-E33-343, which is located on the northwest corner of the B Tank Farm near the 216-B-7A and 216-B-7B Cribs.

A newly installed well detected 4,260 µg/L of uranium near the northwestern corner of the B Tank Farm.

Under the BY Cribs, the highest uranium concentration in FY 2008 was in well 299-E33-38 (388 µg/L). The concentration in this and other wells in the cribs have shown increasing uranium, along with increased concentrations of cyanide, technetium-99, and nitrate. For example, uranium continued to increase in well 299-E33-1A from about 134 µg/L in FY 2007 to 267 µg/L in FY 2008. A strong correlation between cyanide and uranium indicates a common source at the BY Cribs. However, further work on transport pathways and source terms are needed in this area.

2.10.3.2 216-B-63 Trench

The groundwater beneath the 216-B-63 Trench is monitored, as required by WAC 173-303-400 and 40 CFR 265.93(b), for detection of hazardous waste/hazardous waste constituent impact to groundwater. The 12 wells of the groundwater-monitoring network are sampled semiannually for contamination indicator parameters (pH, specific conductance, temperature, total organic carbon, total organic halides, and turbidity). Required groundwater quality parameters (alkalinity, metals, phenols, and anions) are monitored on an annual schedule (PNNL-14112, *Groundwater Monitoring Plan for the 216-B-63 Trench On the Hanford Site*). Appendix B contains a list of wells in the monitoring network, their locations, and groundwater constituents monitored. Groundwater samples were collected and analyzed as scheduled at all 12 wells monitoring the 216-B-63 Trench in FY 2008. No specific evidence of hazardous waste/hazardous waste constituents impacting groundwater was detected at the 216-B-63 Trench during FY 2008.



gwf08_292

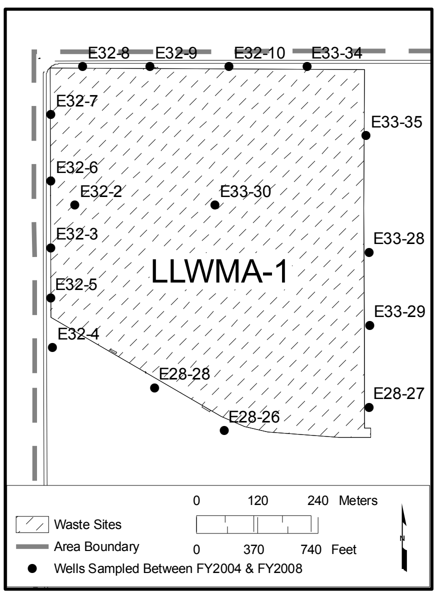
In FY 2008, statistical comparison values for four indicator parameters (pH, specific conductance, total organic carbon, and total organic halide)

Sampling results for the 216-B-63 Trench in FY 2008 support the interpretation that waste from the facility has not affected groundwater.

were not exceeded at the 216-B-63 Trench; problems with the total organic halide analyses in the laboratory during the third quarter resulted in an exceedance that was confirmed to be false upon reanalysis. Specific conductance is the only required parameter showing a trend. Specific conductance continues to increase, which is consistent with a corresponding increase in common soil minerals (e.g., calcium, sodium) and anions (e.g., chloride, sulfate). Although not a required parameter, tritium concentrations continued to decline.

The determination of the groundwater flow direction and rate beneath the 216-B-63 Trench continues to be problematic. The hydraulic gradient is too low to define a flow direction or rate with certainty. Regionally, flow direction at Low-Level WMA 1 appears to be to the north-northwest. Using measured head differences between wells and results in a gradient of 0.00096 (Appendix B), although the gradient is more likely to be closer to the regional gradient of 0.00002. The resulting flow direction is problematic. Both western and southern directions can be calculated, with rates on the order of 0.9 m/day. Given the presence of the basalt subcrop to the north and higher heads to the east and northeast, a western component of flow would be expected. A low-gradient evaluation study currently is underway for Low-Level WMA 2, which will incorporate some of the 216-B-63 Trench wells; this study will help to reduce uncertainty in the flow direction.

2.10.3.3 Low-Level Waste Management Area 1



Groundwater at Low-Level WMA 1 continued to be monitored under RCRA and AEA. Under 40 CFR 265.93(b) (as referenced by WAC 173-303-400), the 17 wells in the network were sampled semiannually for RCRA indicator and site-specific parameters (PNNL-14859; DOE/RL-2000-72). The wells were successfully sampled during the scheduled samplings. Appendix B includes a well location map, a list of wells, and the constituents monitored.

The groundwater gradient in this part of the 200 East Area is low, making the determination of groundwater flow direction difficult. However, precision measurements incorporating careful land surveying, gyroscopic surveying, and tape measurements confirm previous estimates of flow generally to the northwest. Based on movement of the uranium and nitrate contamination, flow direction to the northwest is consistent with the measurements. Past analysis of water-level data also indicate flow toward the northwest. Given the variability and low gradient, no meaningful flow rate could be calculated. The FY 2008 data were used to define a flow direction to the north. However, considerable uncertainty remains to determine a dominant flow direction. In addition, the temporal and spatial variability in flow are not understood. For these reasons, no attempt will be made to update the interim status designation of upgradient and downgradient wells until a stable flow direction is re-established.

During FY 2008, statistical comparison values for four indicator parameters (pH, specific conductance, total organic carbon, and total organic halide) were not exceeded at Low-Level WMA 1, with one exception. Specific conductance exceeded the statistical upgradient/downgradient comparison value (critical mean) in downgradient well 299-E33-34, with values ranging from 784 to 806 µS/cm. Ecology was notified of this and past exceedances as required. This continues a generally increasing trend since 1998. West of well 299-E33-34, well 299-E32-10 exceeded the statistical comparison value with a value of 1,847 µS/cm because of increasing background concentrations. The specific conductance exceedance is related to a regional nitrate plume (Figure 2.10-4). Several wells showed elevated total organic carbon results during FY 2008 sampling. None of the wells had average concentrations for the replicate samples above the statistical comparison value. The elevated results are suspected to be laboratory errors. Results for Low-Level WMA 1 quadruplicate samples remained variable in FY 2008, but all averages were below the statistical comparison value. The pH results for all wells were below the statistical comparison value in FY 2008. Appendix B list statistical comparison values for indicator parameters in FY 2008.

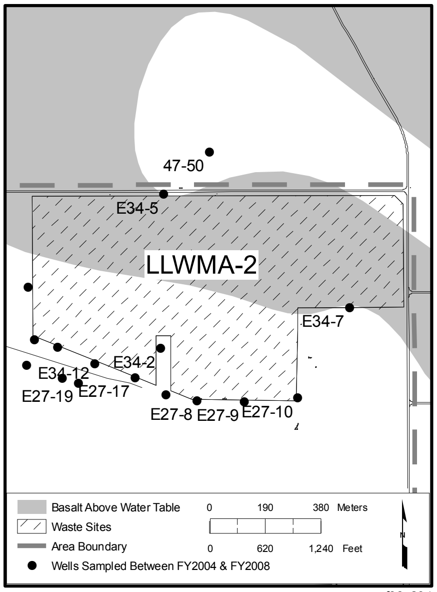
Low levels of mercury are detected consistently in recent samples from well 299-E33-34 (0.18 µg/L), located in the northeast corner of Low-Level WMA 1. Mercury is not commonly detected in Hanford Site groundwater samples and is not considered highly mobile under typical conditions. However, there is some mercury in the vicinity of the BY Cribs (Section 2.10.1.10).

Contaminant levels beneath Low-Level WMA 1 suggest that it does not contribute significantly to groundwater contamination.

Performance assessment monitoring of radionuclides at Low-Level WMA 1, under AEA authority, is designed to complement the RCRA detection monitoring and is aimed specifically at monitoring radionuclide materials not regulated under RCRA. Performance assessment monitoring at Low-Level WMA 1 is conducted per DOE/RL-2000-72. Data are gathered to assess changes in concentrations at downgradient wells and to provide sufficient supporting information from upgradient wells to interpret the changes.

Semiannual monitoring for iodine-129, technetium-99, tritium, and uranium is conducted specifically for performance assessment. Iodine-129 contamination in this area is consistent with regional plumes and the probable source is liquid waste facilities (Figure 2.10-5). Technetium-99 concentrations continued to be elevated in several wells (299-E33-34, 299-E32-10, and 299-E33-35) near the northeast corner of Low-Level WMA 1. The maximum technetium-99 concentration in well 299-E33-34 was 16,000 pCi/L in FY 2008. The contamination levels are consistent with regional plumes that appear to have originated near the BY Cribs (Figure 2.10-6). Wells 299-E32-2 and 299-E32-6 (near the west boundary of Low-Level WMA 1) continued the recent increasing technetium-99 trend in FY 2008. However, levels remained below 60 pCi/L and were only slightly higher than surrounding and upgradient wells. Tritium contamination likely originates from regional plumes not related to the burial grounds (Figure 1.0-2). Tritium concentrations were less than the drinking water standard in FY 2008. Concentrations that had been increasing along the north and east side of the WMA declined slightly in late FY 2008, except in well 299-E33-34. Uranium values remained steady in well 299-E33-34 (located in the northeast corner of the WMA) after an increase that began in FY 2002. The uranium concentration in well 299-E33-34 was ~84 µg/L in January 2008 and ~103 µg/L in June 2008. This is associated with a relatively recent plume, with possible origins near WMA B-BX-BY (Figure 2.10-8). The uranium plume has impacted other wells surrounding this part of the WMA (e.g., wells 299-E32-10 and 299-E33-35), but concentrations are significantly less (23 and 8 µg/L, respectively). Uranium levels were stable in most wells on the west side of Low-Level WMA 1 in FY 2008, and remained below the drinking water standard. The history of uranium contamination prior to regular monitoring of the burial ground wells is difficult to establish, but the source may have been cribs west of B Plant and south of the WMA.

2.10.3.4 Low-Level Waste Management Area 2



gwf08_294

Groundwater at Low-Level WMA 2 continued to be monitored under RCRA and AEA. Under 40 CFR 265.93(b) (as referenced by WAC 173-303-400), the well network was sampled semiannually for RCRA indicator and site-specific parameters (PNNL-14859; DOE/RL-2000-72). The 9 wells were successfully sampled during the scheduled samplings. Appendix B includes a well location map, a list of wells, and the constituents monitored.

The groundwater gradient in this part of the 200 East Area is very low. Groundwater flow appears to be generally to the west-southwest, based on small differences in head at wells along the south boundary of Low-Level WMA 2. However, several wells show consistently low head, suggesting borehole deviation (the extra length of the well bore from deviation increases the apparent depth to water). Trend surface analysis indicates flow toward the southwest (~220º) with a gradient of 0.004 (average of October and April gradient magnitudes). However, the trend surface analysis is influenced by well 299-E34-5, which went dry during the analysis. Omitting well 299-E34-5 from the trend surface analysis provides a more reasonable gradient of 0.0003, but the flow direction of 12º is not likely correct because of the presence of basalt above the water table to the north and the development of contaminant plumes. The movement of the nitrate plume from well 299-E34-7 to well 299-E27-10 indicates a flow to the southwest. Historically, the gradient has been calculated using wells along the southern boundary of the WMA, assuming flow to the west. If the gradient is calculated between wells 299-E27-10 and 299-E27-17 using the March 2008 data, the value is 0.00005.

No attempt will be made to update upgradient well designations used in the statistical tests until a stable flow direction is evident. The basalt surface above the water table in the northern part of Low-Level WMA 2 constrains possible flow directions for the unconfined aquifer. However, it is possible that the flow is influenced by continued drainage of the unsaturated sediment and recharge moving laterally on the basalt surface to the saturated aquifer sediment. Given the broad uncertainties in flow direction and low gradient in this area, flow rates are not estimated. A low-gradient evaluation study is planned in FY 2009 for Low-Level WMA 2, which is expected to reduce the uncertainty in flow direction.

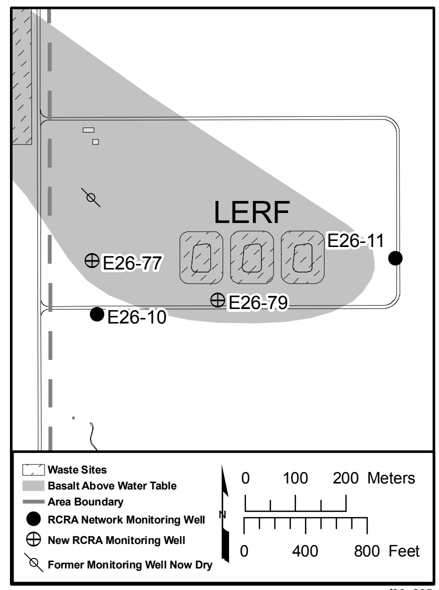
Levels of specific conductance, total organic carbon, and total organic halides in an upgradient well at Low-Level WMA 2 were elevated. The source probably originates outside the Low-Level WMA.

Statistical comparisons for the four indicator parameters (pH, specific conductance, total organic carbon, and total organic halide) did not indicate that Low-Level WMA 2 has adversely impacted groundwater quality. The average pH in downgradient well 299-E34-12 exceeded the upper limit of the critical range in October 2007. However, verification sampling did not confirm the increase. Specific conductance along the south side of the area has exhibited a generally increasing trend in the eastern wells (299-E27-10, 299-E27-9, and 299-E27-8) for the past several years. These wells appear to be impacted by groundwater with elevated concentrations of sulfate, chloride, nitrate, calcium, total organic carbon, and total organic halides detected in well 299-E34-7 (PNNL-15670). These trends may support a component of flow to the west.

Well 299-E34-7 went dry in early FY 2007 and has been removed from the sample schedule. Appendix B lists the initial statistical comparison values for FY 2008 based on data for the other upgradient wells.

Performance assessment monitoring of radionuclides at Low-Level WMA 2, under AEA authority, is designed to complement the RCRA detection monitoring and is aimed specifically at monitoring radionuclide materials not regulated under RCRA. The current monitoring plan (DOE/RL-2000-72) includes technetium-99, iodine-129, and uranium specifically for performance assessment.

Technetium-99 concentration remained steady in well 299-E27-10 (located southeast of Low-Level WMA 2), with an approximate concentration of 100 pCi/L in FY 2008. Since it is an upgradient well, the contamination probably is a result of past disposal of liquid waste in the 200 East Area, not activities related to Low-Level WMA 2. Other wells in the monitoring network have lower technetium-99 concentrations. Iodine-129 concentrations were below 5 pCi/L in Low-Level WMA 2 wells. The levels were consistent with the regional iodine-129 plume (Figure 2.10-5) and likely are unrelated to a burial ground source. Uranium concentrations in Low-Level WMA 2 samples were less than 5 µg/L and do not indicate a burial ground source.



gwf08_295

2.10.3.5 Liquid Effluent Retention Facility

The Liquid Effluent Retention Facility operates under final status permit conditions agreed to by the DOE and Washington State Department of Ecology (Ecology). The facility is scheduled to be clean-closed when operations are terminated. The permit was updated in FY 2008 to account for revised analytical methods. During FY 2008, two new wells (299-E26-77 and 299-E26-79) were drilled in the vicinity of the Liquid Effluent Retention Facility; application will be made to Ecology to re-establish the monitoring network incorporating the new wells with 299-E26-10 and 299-E26-11. Well 299-E26-77 is west of the basins (near dry well 299-E26-9) and 299-E26-79 is south of the west edge of basin 43. Well 299-E26-79 was drilled and sampled in FY 2008; however, the well was not accepted until FY 2009. These wells were completed in the upper 6.1 m of fractured basalt flow top and produced sufficient water for sampling purposes.

The DOE and Ecology are negotiating a process to modify the RCRA permit that will lead to a more refined understanding of Liquid Effluent Retention Facility hydrostratigraphy and will create a regulatory framework to incorporate the new wells into the monitoring network. Wells 299-E26-77 and 299-E26-79 will be sampled semiannually on the same schedule as wells 299-E26-10 and 299-E26-11. Analysis of samples collected during the drilling and construction process indicate that all constituents in the permit were either undetected or below drinking water standards. Tentatively, the DOE will submit an application to Ecology to add these two wells to the Liquid Effluent Retention Facility monitoring network. Public comment and involvement is necessary to add the wells to the Liquid Effluent Retention Facility well network; however, a temporary authorization is available through the regulations. Hydrologic tests are planned in FY 2009 to comply with the stipulations in the permit; borehole deviation will be measured in the new wells and water level measurements conducted. Groundwater gradients at Liquid Effluent Retention Facility are likely to be similar to the regional gradient of 0.00002. Additional analyses of this area are planned in FY 2009 to reduce error through precision surveying and gyroscopic surveys to increase the accuracy of the gradient calculation incorporating the new wells.

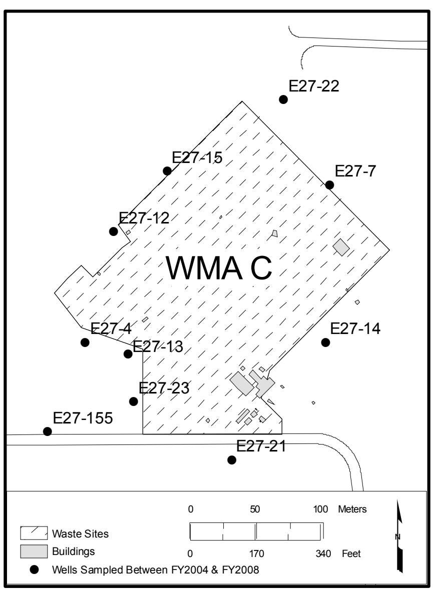
Two new wells yielding sufficient water for sampling were drilled into fractured basalt flow top at the base of the unconfined aquifer. They will help to form a new RCRA-compliant monitoring network at the Liquid Effluent Retention Facility.

Groundwater gradients at Liquid Effluent Retention Facility are likely to be similar to the regional gradient of 0.00002.

In FY 2008, specific conductance and sulfate results slightly increased in well 299-E26-10. Nitrate also has been rising in this well, and in wells south and east of the Liquid Effluent Retention Facility. The regional rise of anions and cations is evident in wells located in the central and eastern portions of the 200 East Area. Downgradient wells installed before the Liquid Effluent Retention Facility began receiving waste recorded the early indications of the regional rise in specific conductance.

The uppermost aquifer beneath the Liquid Effluent Retention Facility is being evaluated as part of a groundwater evaluation plan. The results of the drilling of the new wells suggest that the fractured basalt flow top makes up the basal portion of the unconfined aquifer; no low hydraulic conductivity layer separates the basalt from overlying sediments and 6 to 8 gal/min of water were produced. The current plan assumes that groundwater continues to move in a southwest direction at ~0.24 m/day (PNNL-14804, *Results of Detailed Hydrologic Characterization Tests – Fiscal year 2003*), but detailed analysis will be conducted in FY 2009 incorporating water level data from the new wells.

2.10.3.6 Waste Management Area C



gwf08_296

Groundwater at this WMA is monitored under RCRA interim status monitoring. Monitoring of indicator parameters shows if dangerous waste constituents associated with the facility have compromised groundwater quality as required under 40 CFR 265.93(b) (as referenced by WAC 173-303-400) and AEA. Although semiannual sampling is required by RCRA, wells are sampled quarterly in accordance with tank waste retrieval monitoring requirements (e.g., RPP-21895, *241-C-103 and 241-C-109 Tanks Waste Retrieval Work Plan*). The required RCRA semiannual sampling confirms that indicator parameter critical means were not exceeded. Radionuclides are tracked under AEA at the site.

WMA C consists of the C Tank Farm, the 244-CR Vault, ancillary waste transfer lines, and seven diversion boxes. The nine wells were sampled on schedule in FY 2008, except for one missed quarterly sample during the fourth quarter at well 299-E27-21. Appendix B includes a well location map, a list of network wells, the critical mean values used for upgradient/downgradient comparisons in FY 2008, and the site-specific constituents. The gradient in the vicinity of WMA C is consistent with the regional gradient of 0.00002. Flow rates are on the order of 0.2 to 0.4 m/day with flow direction historically to the southwest but difficult to confirm. Additional studies are being planned in FY 2009 north of WMA C that may help to clarify the flow direction. The rate of water-table decline beneath WMA C is a few centimeters per year.

In WMA C, specific conductance is close to exceeding the statistical critical value of 922 µS/cm in well 299-E27-14.

During FY 2008, statistical comparison values for the four indicator parameters (pH, specific conductance, total organic carbon, and total organic halide) were not exceeded at WMA C. However, the value for specific conductance at well 299-E27-14 is elevated and exceedance during FY 2009 is possible. In the vicinity of WMA C, specific conductance upgradient ranges from 400 to 500 µS/cm. A maximum value close to the critical mean of 922 µS/cm is observed in well 299-E27-14. Sulfate and nitrate contribute to the specific conductance signature across the site. The rising sulfate concentrations are primarily from an upgradient source. Southeast of WMA C, well 299-E27-14 had a sulfate result of 296 mg/L in September 2008.

Nitrate concentration is increasing in downgradient well 299-E27-14. Consequently, there is little effect on the specific conductance from nitrate.

Technetium-99 concentrations range from 32.2 pCi/L (upgradient well 299-E27-22) to 5,000 pCi/L (downgradient well 299-E27-4). Although upgradient concentrations of technetium-99 have declined (~50 pCi/L in well 299-E27-7), concentrations have increased downgradient. Technetium-99 results in well 299-E27-14 have been above the drinking water standard since FY 2001, with a maximum value of 2,400 pCi/L in FY 2008. Well 299-E27-4 historically has not had increased concentrations; however, during FY 2008, the concentration increased from 1,300 pCi/L in the first quarter to 5,000 pCi/L in the fourth quarter. The source of contamination in downgradient well 299-E27-4 may be a local pocket of contaminated soils. This well is close to several unplanned releases. Elevated technetium-99 concentrations occur with low levels of nitrate, providing a low nitrate to technetium-99 ratio. The source of contamination may be tank-related, as indicated by concentrations in well 299-E27-13 (PNNL-14187: PNNL-14548), which would tend to reduce the likelihood of other sources in WMA C, such as the hot semi-works.

Although sporadic at several locations during FY 2008, cyanide levels dropped in upgradient well 299-E27-7 from 16 to 4 µg/L. The only other detectable cyanide result was 13 µg/L at well 299-E27-14. The C Tank Farm is the only known local source for cyanide (HNF-SD-WM-TI-740, *Standard Inventories of Chemicals and Radionuclides in Hanford Site Tank Wastes*).

Groundwater monitoring in the 200-BP-5 Operable Unit includes the following monitoring activities.

CERCLA and AEA Monitoring (Appendix A)

- ***One hundred three wells are scheduled for annual to triennial sampling. Three wells were not sampled as planned in FY 2008.***
- ***The DOE installed and began sampling nine new wells in FY 2008.***

Facility Monitoring (Appendix B)

- ***Twenty-six wells are scheduled for quarterly to semiannual sampling at Waste Management Area B-BX-BY. One quarterly sample was missed in four wells.***
- ***Twelve wells are scheduled for quarterly to semiannual sampling at the 216-B-63 Trench.***
- ***Seventeen wells are scheduled for semiannual sampling at Low-Level Waste Management Area 1.***
- ***Nine wells are scheduled for semiannual sampling at Low-Level Waste Management Area 2.***
- ***Two wells are scheduled for semiannual sampling at the Liquid Effluent Retention Facility. Two new wells were installed and will be sampled beginning in FY 2009.***
- ***Nine wells are scheduled for quarterly sampling at Waste Management Area C. One quarterly sample was not sampled as planned.***
- ***All wells were sampled as planned, except as noted.***

This page intentionally left blank.

Figure 2.10-1. Facilities and Groundwater Monitoring Wells in the 200 East Area.

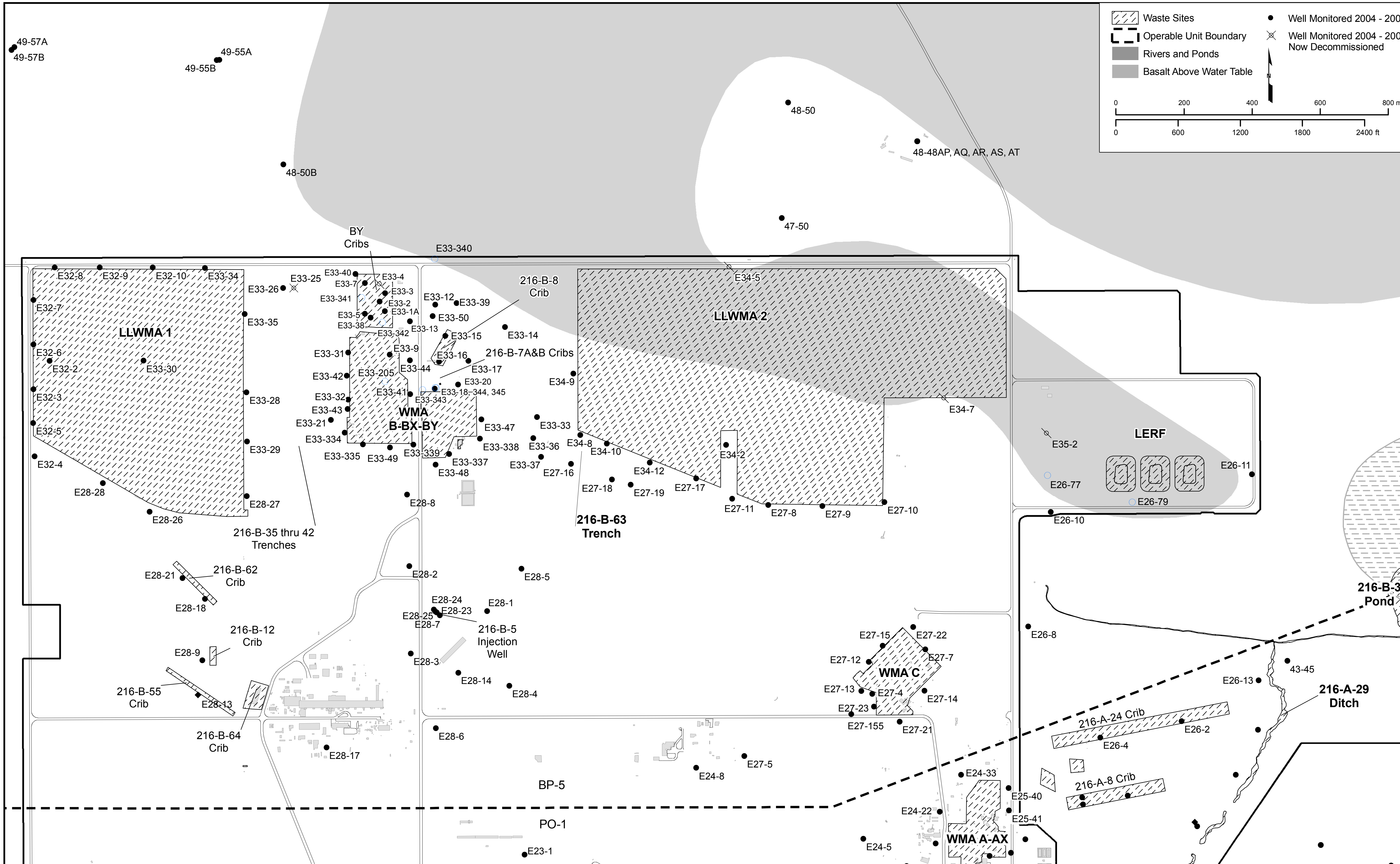
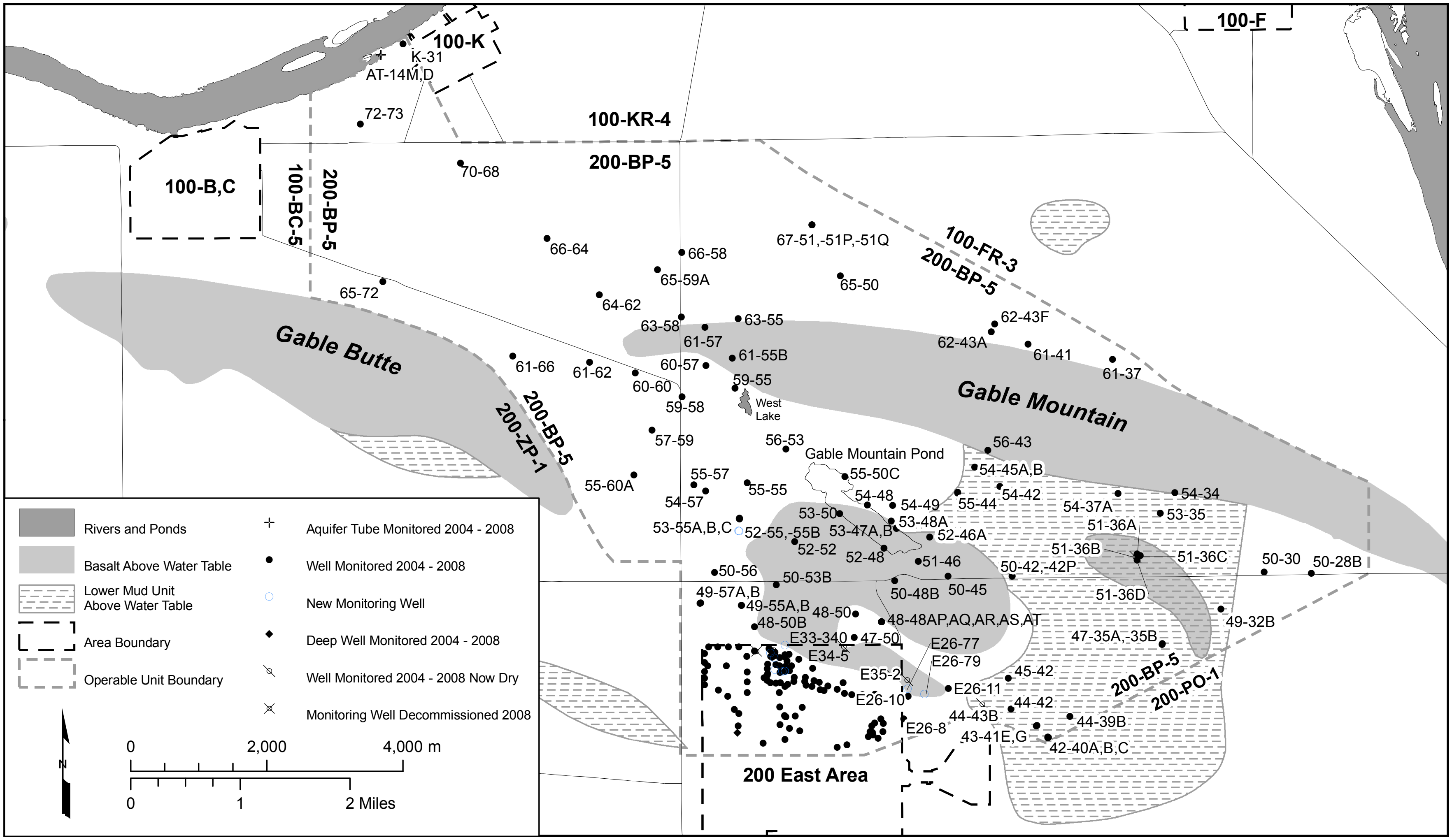


Figure 2.10-2. Facilities and Groundwater Monitoring Wells Located in 600 Area Associated with the 200-BP-5 Operable Unit.



gwf08_298

This page intentionally left blank.

Figure 2.10-3. 200 East Area Water-Table Map, March 2008.

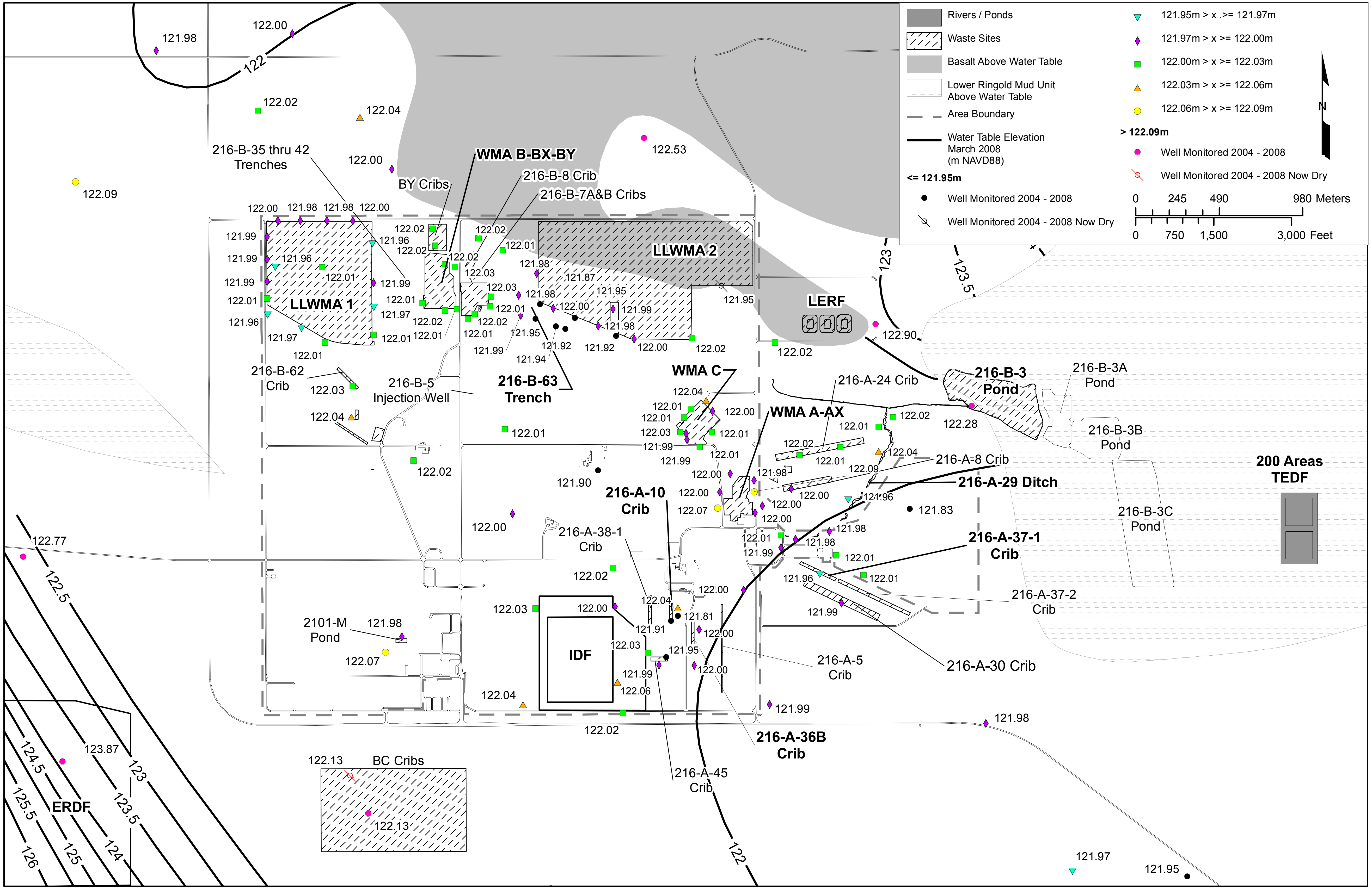
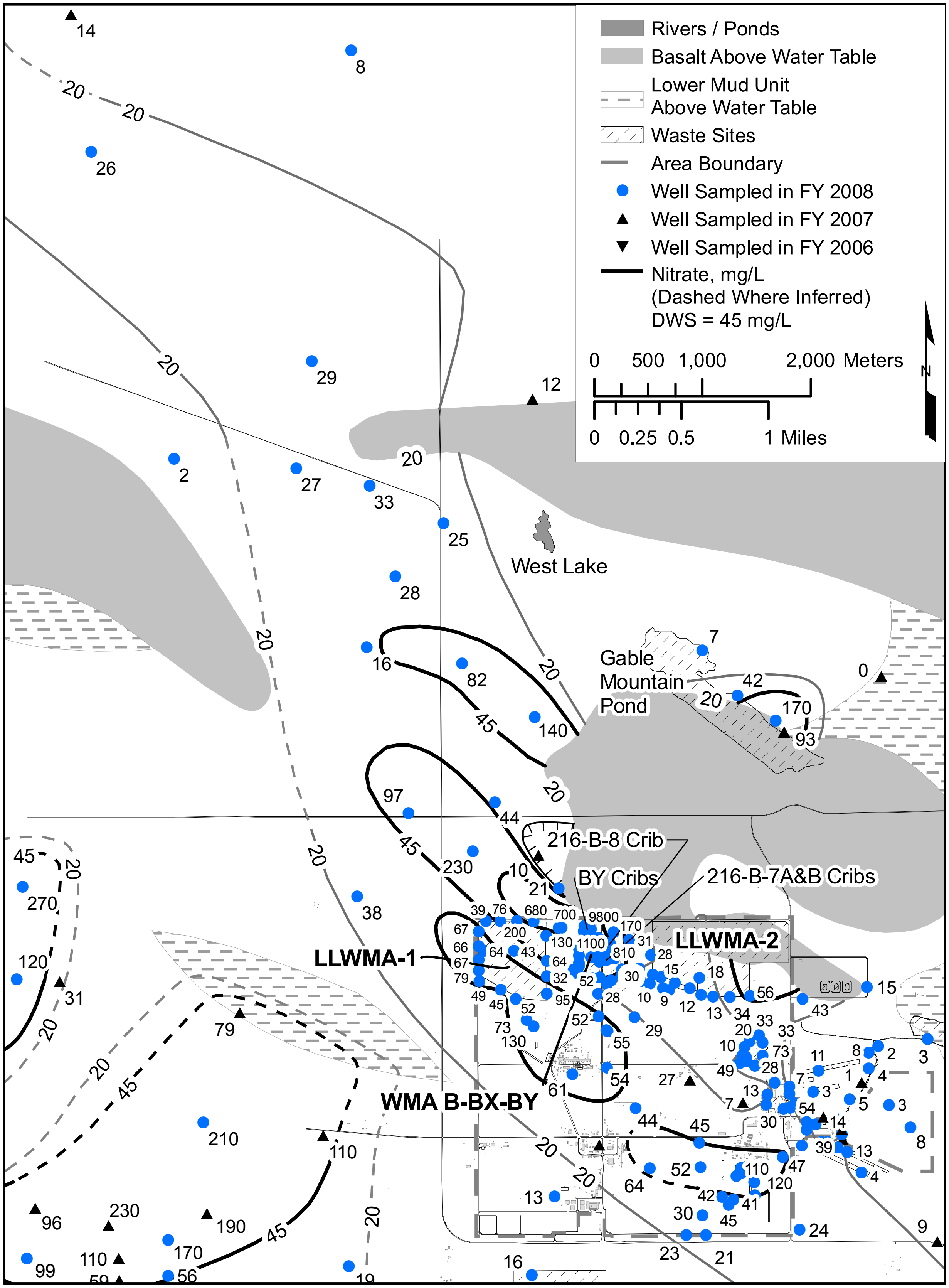


Figure 2.10-4. Average Nitrate Concentrations in the 200 East Area, Upper Part of Unconfined Aquifer.



gwf08_301

Figure 2.10-5. Average Iodine-129 Concentrations in the 200 East Area, Upper Part of the Unconfined Aquifer.

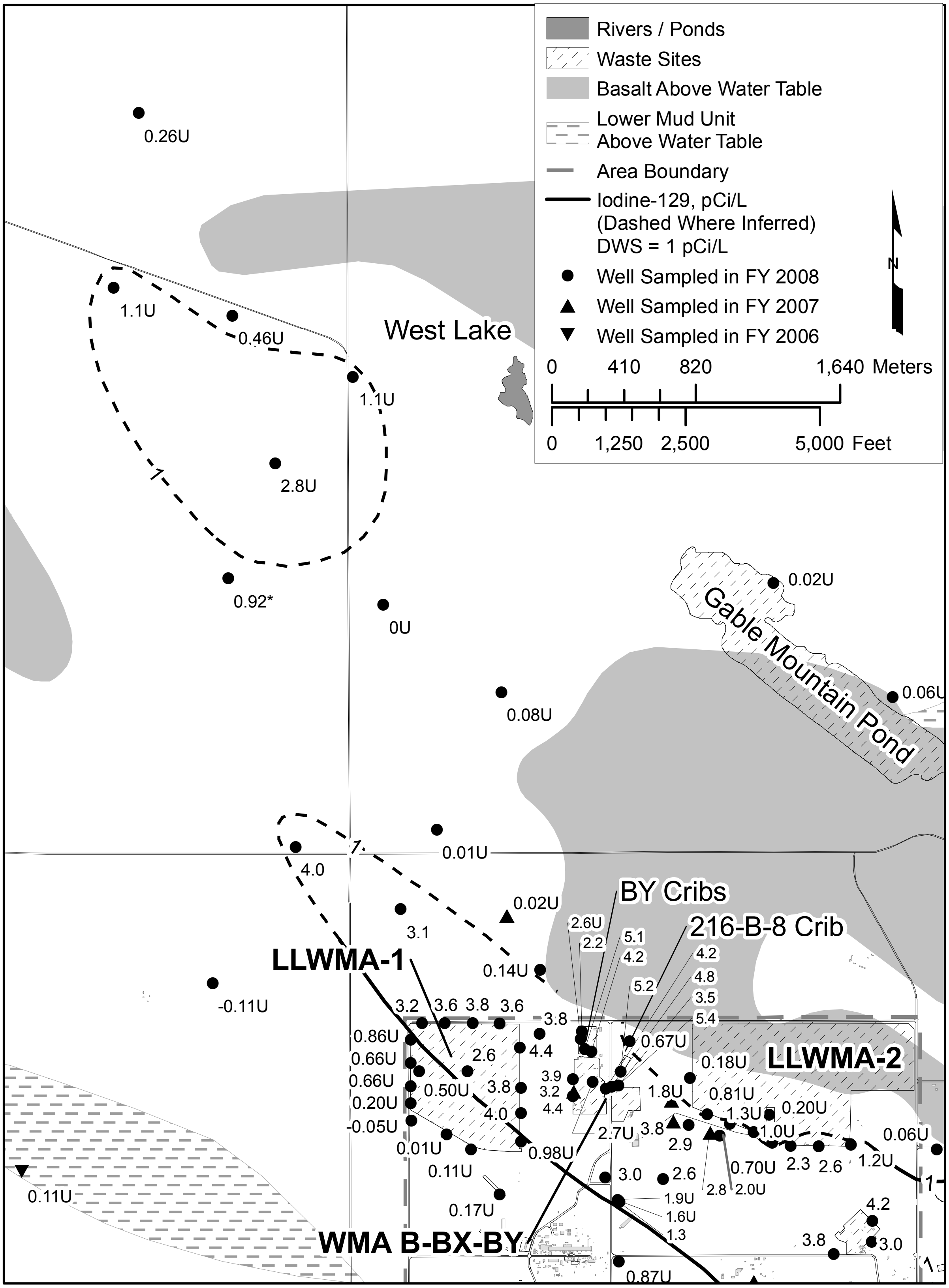
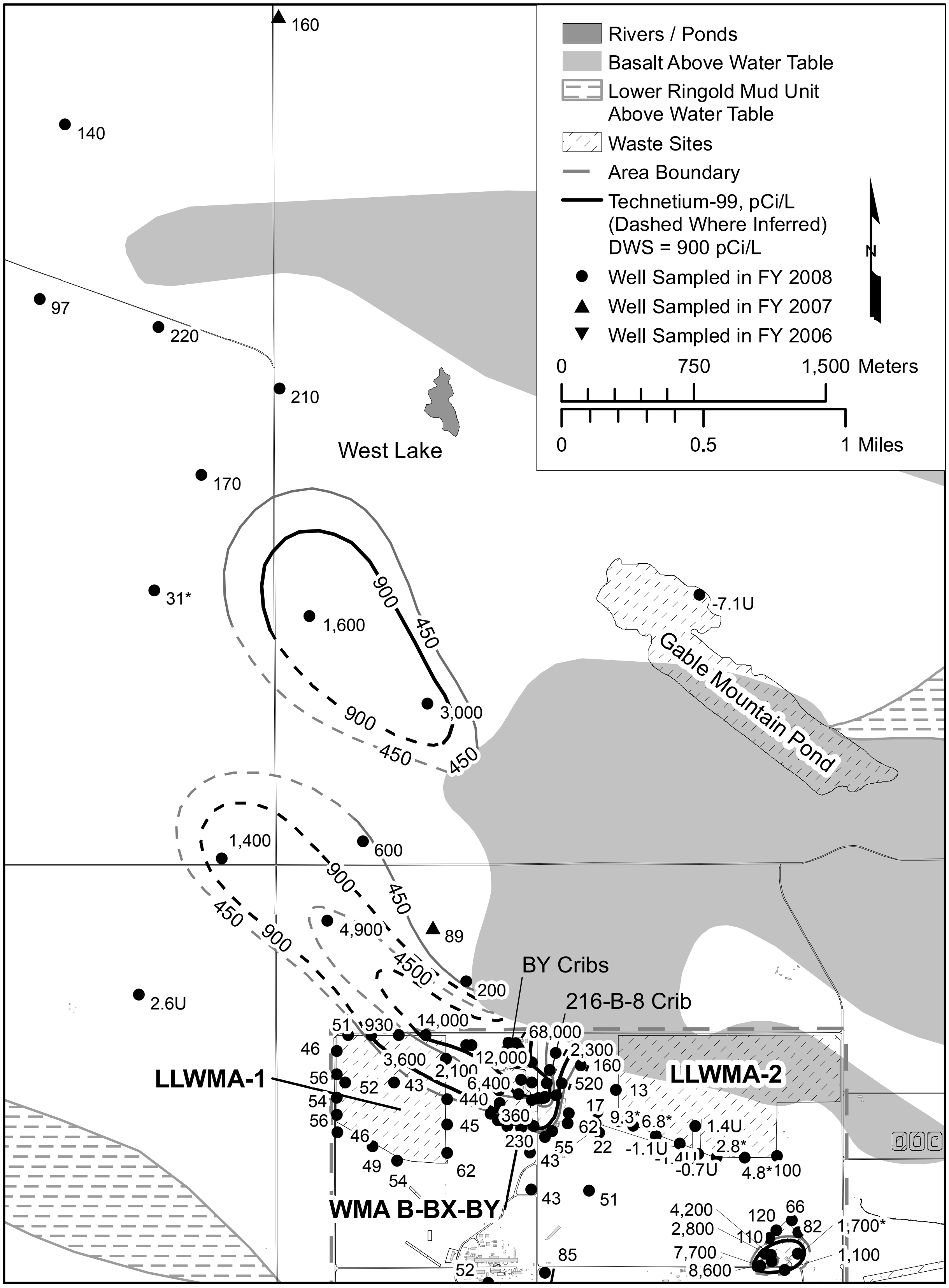


Figure 2.10-6. Average Technetium-99 Concentrations in North 200 East Area, Upper Part of Unconfined Aquifer.



gwf08_303

Figure 2.10-7. Cyanide Concentrations in North 200 East Area, Upper Part of Unconfined Aquifer.

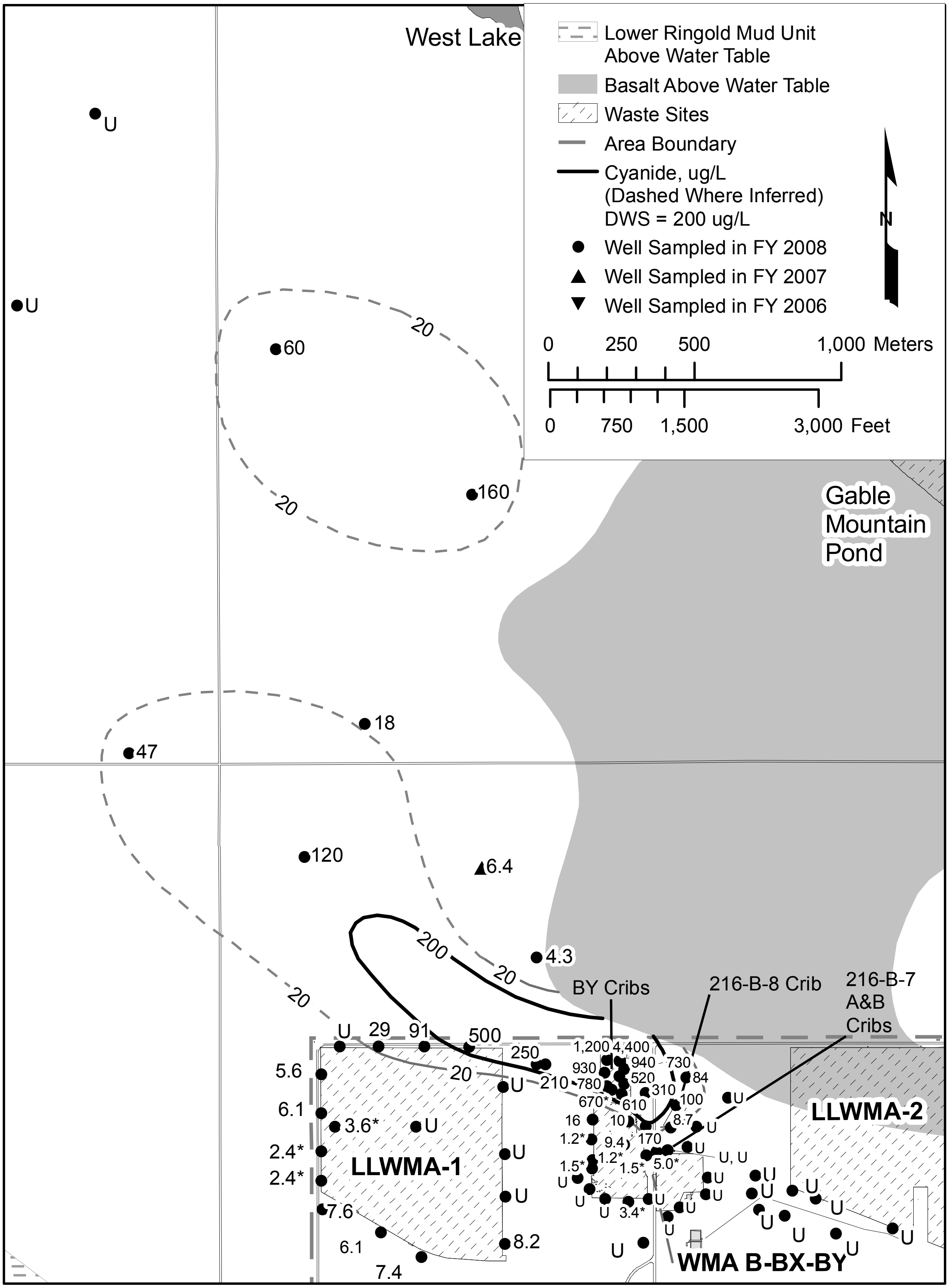
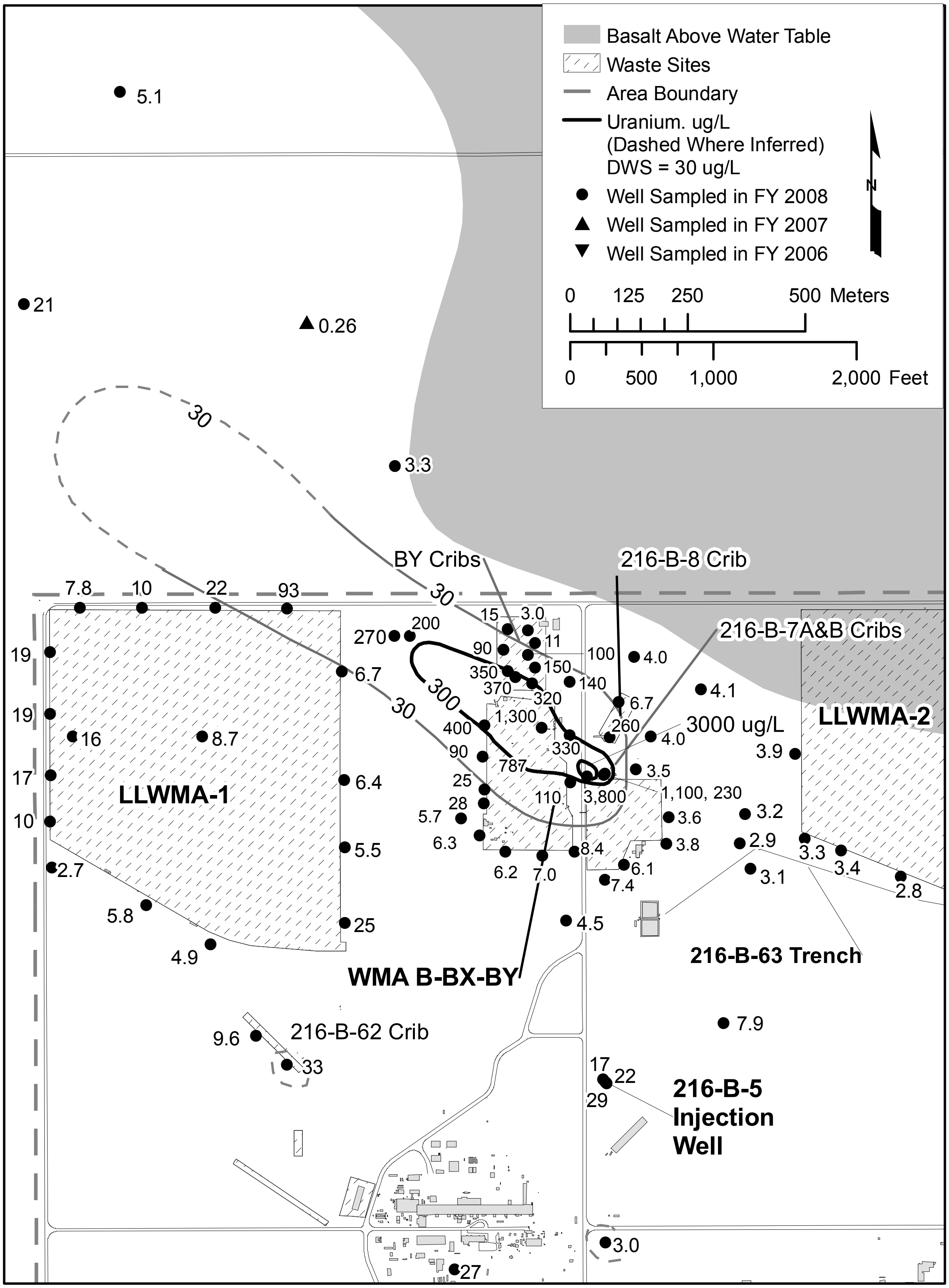
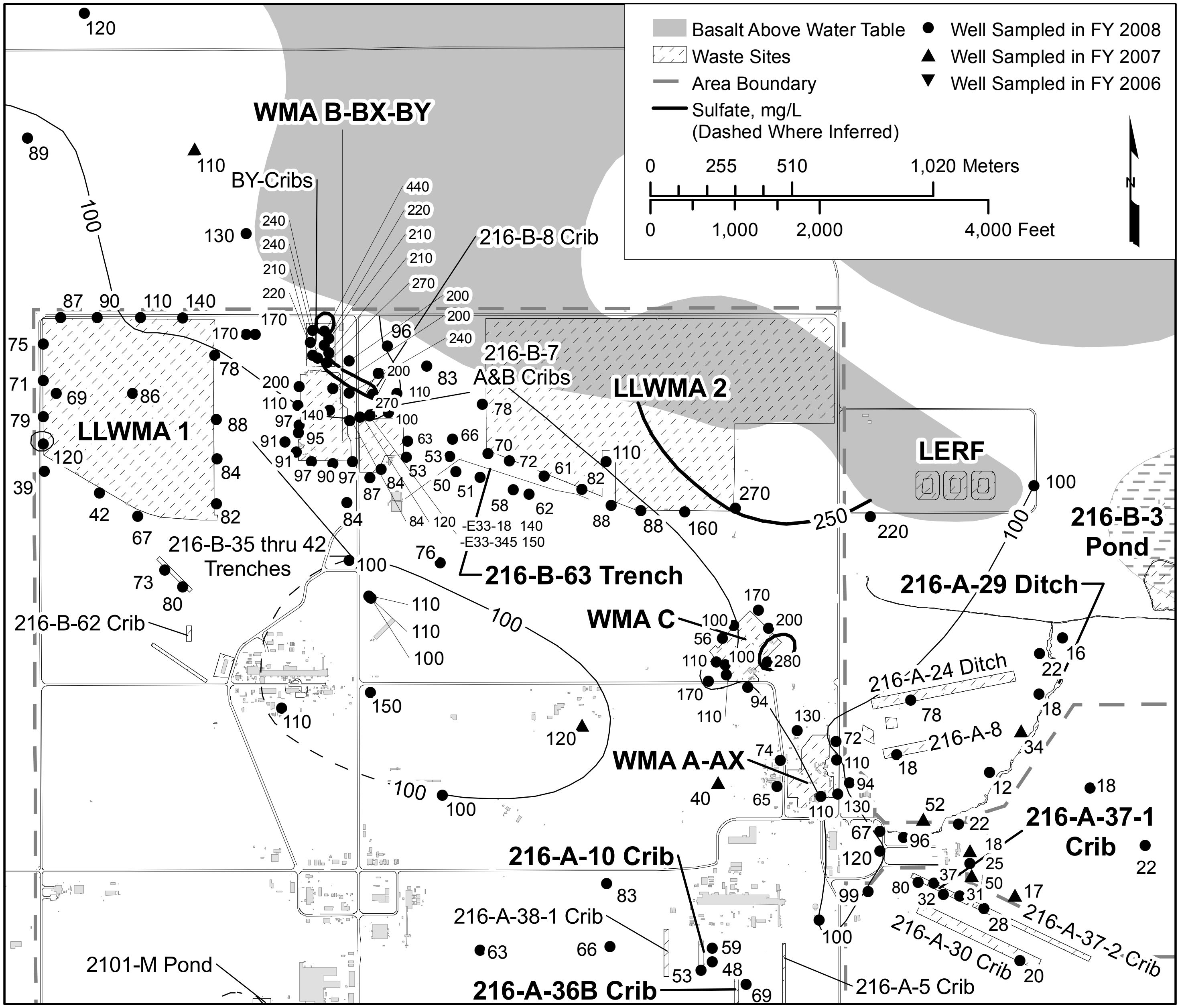


Figure 2.10-8. Average Uranium Concentrations in Northwestern 200 East Area, Upper Part of Unconfined Aquifer.



gwf08_305

Figure 2.10-9. Average Sulfate Concentrations along the Basalt Subcrop, Upper Part of Unconfined Aquifer.



gwf08_306